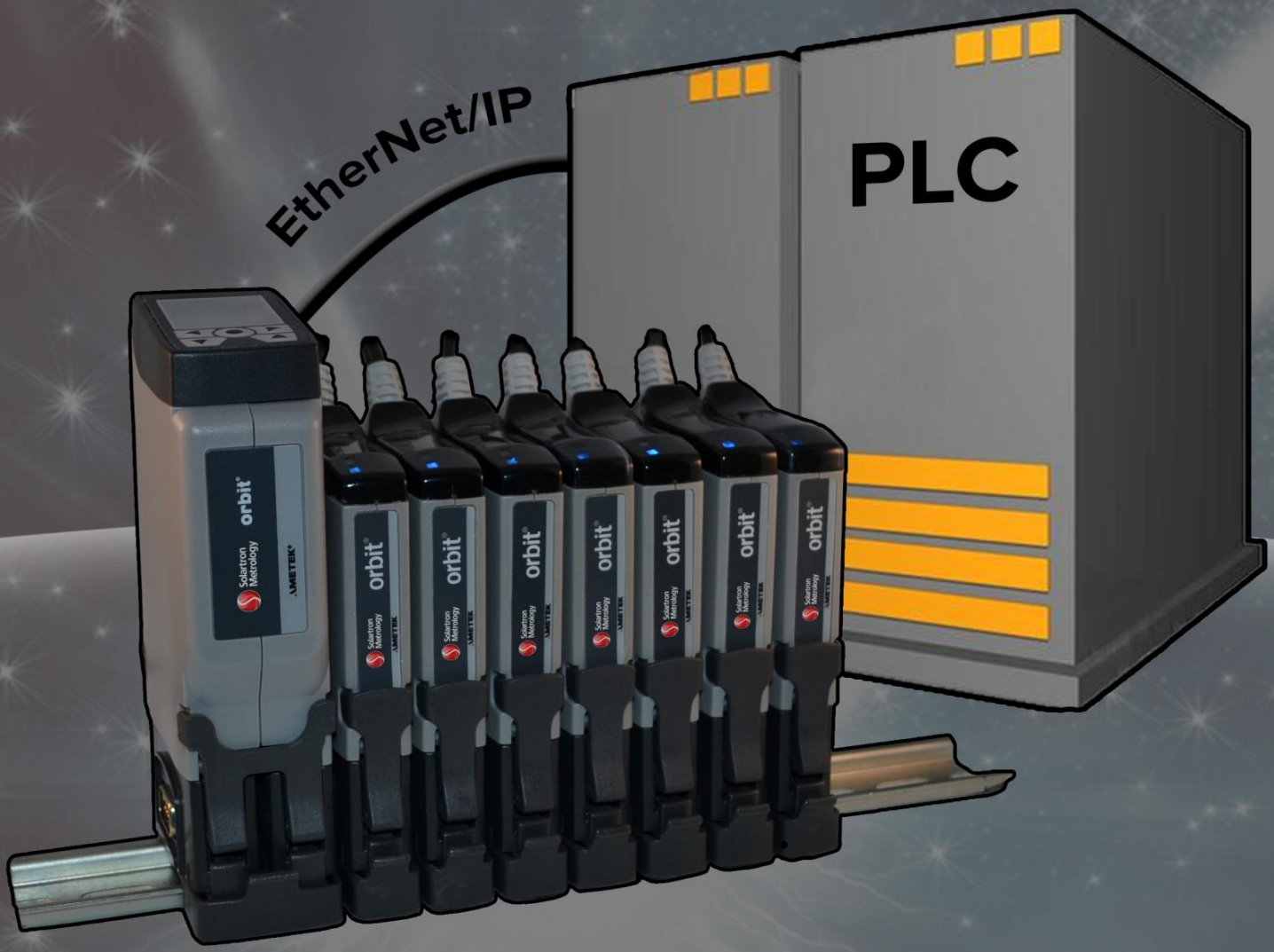
Solartron Metrology

PIM User Manual



AMETEK®
ULTRA PRECISION TECHNOLOGIES

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1. Introduction

This manual specifically caters for the PIM (Protocol Interface Module) products.
The Orbit® PIM system provides products specifically designed to simplify the communications between an Orbit® network of instruments and a standard industrial communications protocol.

Each module contains an integral LCD screen and keypad for monitoring network information and status as well as real-time Orbit® Module Readings.

The Orbit PIM Product has several variants, one for each of the Industrial Networks supported.
Please see the specific section for the Industrial Network you require. These sections provide the network specific information for settings, as well as accessing the information from the Orbit Network of modules (parameter addresses etc) via the specific network communications.

2. Navigate this Document

Hyperlinks are included to aid navigation.

To return to the point where you have jumped from, most pdf readers have a ‘Previous Page View’ button, alternatively use the keyboard shortcut 'ALT' + left arrow key.

3. Safety Summary

WARNING statements identify conditions or practices that could result in personal injury or loss of life. **CAUTION** statements identify conditions or practices that could result in damage to the equipment or other property **Symbols in this manual** Indicates cautionary or other information	**Warnings and Cautions** **Warning**: Do not operate in an explosive atmosphere. **Warning**: This equipment is not intended for safety critical applications **Warning**: Do not exceed maximum ratings as specified in this document under individual modules. **Caution: Low Voltage** This equipment operates below the SELV and is therefore outside the scope of the Low Voltage Directive **Service and Repair** CAUTION: This equipment contains no user serviceable parts. Return to supplier for all service and repair

All of the Products are CE marked and comply with EN61000-6-3 Electrical Emissions and EN61000-6-2 Electrical Immunity and EN61326-1.

For general safety advice, see user leaflet.

4. Trademarks and Copyrights

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Orbit® is a registered trademark of Solartron Metrology Ltd

EtherNet/IP is a trademark of ODVA Inc.

5. Contact Information

For updated information, troubleshooting guide and to see our full range of products, visit our website: www.solartronmetrology.com

6. Documentation cross reference

503286	PIM User Leaflet
520439	Orbit3 Support pack for Windows: *Contains both software and manuals for the Orbit system*
502990	Orbit3 System manual: *Contains Orbit 3 system hardware information*
	PIM_EtherNetIP_IF_ADI_Map.csv: *A csv file describing all parameters available through Explicit Messaging*
	PIM_EthernetIP_IF_CyclicRead.csv: *A csv file describing all parameters available through Implicit 'Read' messaging*
	PIM_EthernetIP_IF_CyclicWrite.csv: A csv file describing all parameters available through Implicit 'Write' messaging

7. Glossary

Terms used in this manual

Display	The Liquid Crystal Display on the top of the module providing displayed information
Keypad	The five way keypad on the top of the module allowing display navigation
USB Interface	The PIM includes a Mini-USB socket used for connecting to a PC for configuration, monitoring & firmware updates
Digital Probe	A standard Solartron product that can be connected to the PIM to form a multi-channel measurement system
Connection Unit	Base Module to allow the unit to be mounted on a DIN rail or screwed down to a mounting plate as well as providing connections to digital probes (known as a TCON on the Solartron Orbit system)
Anybus Interface	The interface from the PIM to the specific Industrial Network in use

8. Installation

Note. The PIM Series of products are not sealed instruments and care should be taken when installing in environments where contamination can come into contact with the unit.

8.1. PC System Requirements

8.1.1. PC Hardware Requirements

- Personal computer with a processor running at 1GHz or faster with 2GB or more RAM.
- An available USB port.

8.1.2. PC Software Requirements

- Microsoft Windows® operating system (Windows® XP, or later)
- Solartron Orbit3 Support Pack for Windows.

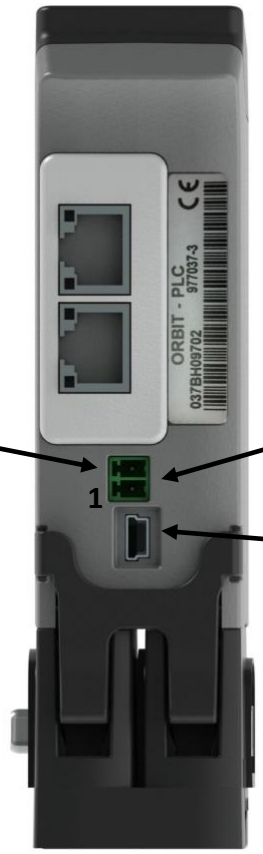
8.2. Installing the Orbit3 Support Pack for Windows® software

Important! *Please ensure that you have Administrative access rights for installing this software.*
Before you can use the PIM, you must have the Orbit3 Support Pack for Windows® software installed on your computer; this is freely available from the Solartron website (http://www.solartronmetrology.com).

This will install the latest version of this manual, the PIM configuration application and Orbit3 Updater that are required for using PIM products.

8.3. Connections

This section describes how to connect the unit.



Input Connections
2 0V Power
1 18-32V DC Power
(see below for supplied
Power supply connections)

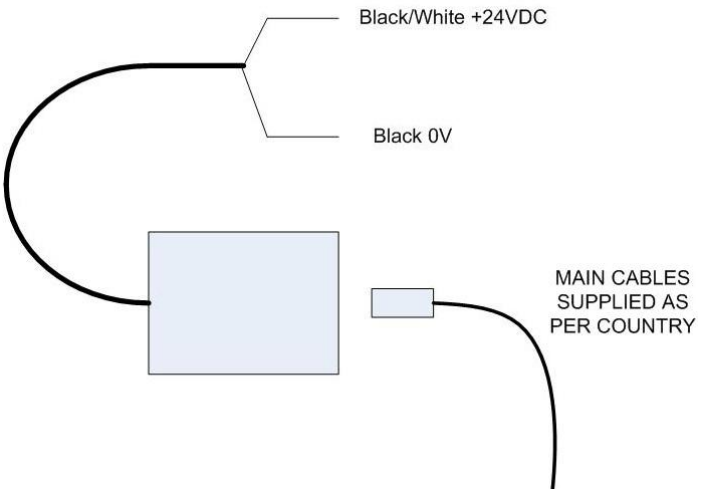
A mating connector is supplied with each unit
(This can be removed for wiring)
Additional connectors can be purchased from Solartron Metrology or Camden Part No. CTB93HD/2 or IMO Part No. 21.155 MH/2

Mini USB,
For configuration, monitoring & firmware updates

Operating Currents (mA) (nominal)		
Input Voltage	**PIM**	**PIM + 2DP**
18 V DC	120	150
24 V DC	100	120
32 V DC	80	100

DO NOT CONNECT ANY POWER SOURCES TO THE 9 WAY D-TYPE OF THE PIM

8.4. Mains to +24V DC Power Block (supplied)



8.5. Power Supply Details

- The PIM works with up to 150 Orbit modules (although the specific external Industrial Network may have further constraints).
- Provides Orbit power for 10 Orbit Modules.
- Provides Auxiliary power for 4 Orbit Laser modules.

For more power supply configuration details see the ‘Electrical Installation’ section of the Orbit3 System manual.

8.6. Grounding, cables and power supplies

It is advisable to provide a good ground point for the PIM.

The PIM can be connected to a network of Solartron Digital probes via its 9 way D-type connector. If both the PIM and the Digital probes are mounted on a DIN rail, additional grounding may be performed using the mounting bracket (see diagram).

Note. The Orbit bus is a multi-drop RS485 network, therefore it is recommended that the provided Orbit Terminator is fitted to the end of the bus.

8.7. Noisy Electrical Environments

This section discusses the type of installation required, depending on the electrical environment.
Typically, this will be an industrial environment where there is equipment likely to produce high levels of electrical interference, such as welders, machine tools, cutting and stamping machines.

Connections should be made using screened cable. Braided or foil screened cables may be used. The cable screen should be connected to the Orbit PIM unit at the 0V connection.

In some particularly noisy environments it may be necessary to add ferrite filter components on power and/or data cables.

When selecting the type of wire or cable to be used, consider the following parameters:

- Screening
- Conductor size (resistance)
- Mechanical aspects such as flexibility and robustness

This is not a complete list. Installations may require other special cable characteristics.

8.8. Status Indication

The PIM provides operational status information on its built in display. See Displays
Also, PLC network protocol specific status is provided on the built in Anybus module, located at the rear of the PIM. See the relevant PLC Network Protocols section of this manual for further details.
Attached Digital probes have two indication LEDs.

- The blue Led is on when the PIM and Digital probes are communicating.
- For error conditions, the red Led will flash or be permanently on. See the 'Diagnostics' section of the Orbit System manual for error status details.

8.8.1. Displays

There are three main screens which are navigated using the buttons on the user interface.

Note: the display does not operate while USB is connected to a PC and will show "External Monitor".

8.9. External Network Information

The first page shown on the display provides Network information for the External Industrial Network (for example, the EtherNet/IP version of the PIM shows DHCP enable / disable, IP Address, Subnet Mask and Default Gateway settings).
See the relevant PLC Network Protocols section of this manual for further details.

8.10. Orbit Network Information

The second page available on the display provides basic information about the Orbit Network of Modules – Number of modules and Network Error State.

8.11. Orbit Module Readings

The third page available on the display provides a reading value and bar-chart for two modules. Which two modules are displayed can be indexed through the buttons, allowing the reading for any module on the Orbit network to be displayed in real-time.

Note: The display will also show basic status information in place of the reading when the status is not 'Ok', this includes "OverRange", "UnderRange" or "Error".

9. PIM Configuration / Windows Application

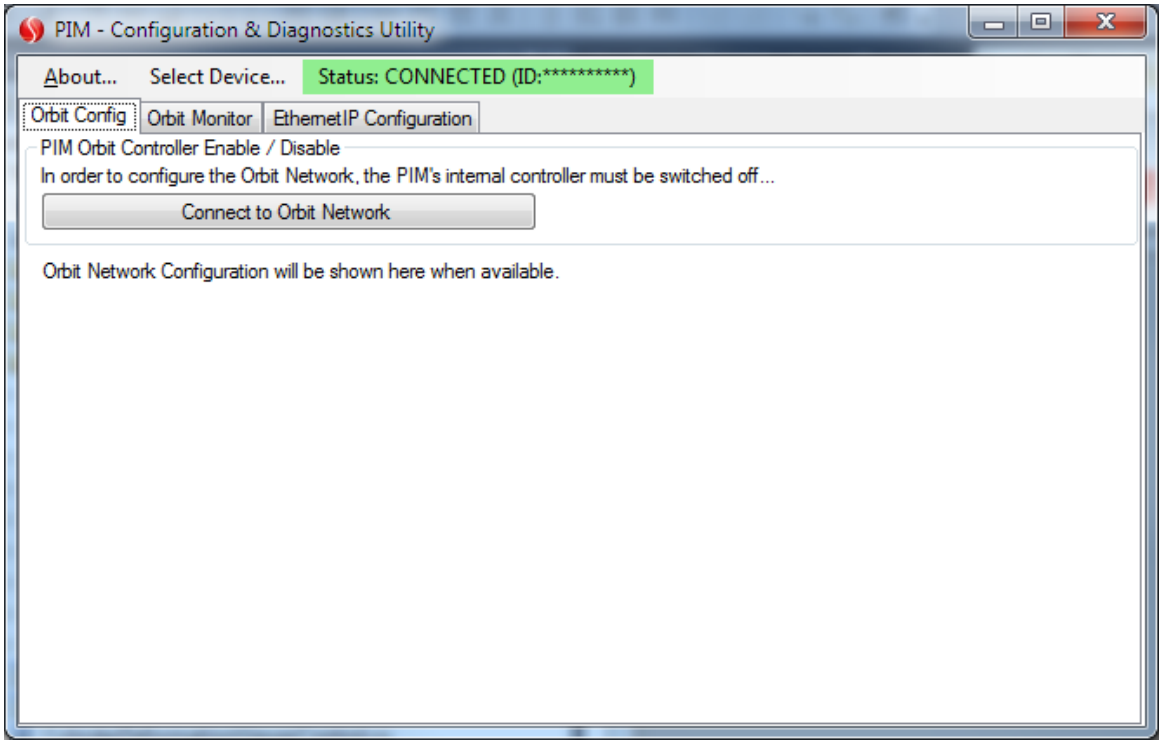
For easy setup of the PIM, a configuration application for Windows based PCs is available, included with the Orbit3 Support Pack for Windows.

The PIM unit must be connected to the PC via the USB mini B Port on the rear of the unit and then powered in the normal way (the PIM cannot be powered via the USB lead).

The application allows the user to configure (and monitor) the Orbit Network of Modules connected to the PIM, as well as configure (and monitor) the external Industrial Network.

When the application is first run, the “Select Device” menu item should be used to identify and connect to the required PIM device.

Once connected the application provides multiple ‘tabs’ (see below). The first two are for configuring and monitoring the Orbit Network of Modules, while the remainder are for configuration and monitoring of the External Industrial Network.


PIM - Configuration & Diagnostics Utility
About...
Select Device...
Status: CONNECTED (ID:**********)
Orbit Config
Orbit Monitor
EthernetIP Configuration
PIM Orbit Controller Enable / Disable
In order to configure the Orbit Network, the PIM's internal controller must be switched off...
Connect to Orbit Network
Orbit Network Configuration will be shown here when available.

The following sections describe the Orbit Configuration and Monitoring tab usage. The External Network Configuration and Monitoring tabs are specific to the particular network in use. See the relevant PLC Network Protocols section of this manual for further details. regarding the specific network setup.

9.1. Orbit Configuration Tab

9.1.1. Background

The PIM includes within it an Orbit Network Controller - which performs all the communications with the local Orbit Network of Modules. In order to configure the Orbit Network, the configuration application needs to ‘take-over’ control of the network. Therefore, the Orbit configuration can only be accessed by ‘Switching off’ the PIMs internal Orbit Controller and allowing the application to take over control of the Orbit Network.

9.1.2. Usage

Once the Orbit Config tab is selected: -

1. **Click the 'Connect to Orbit Network' button.**
   a. *The application will take a few seconds to disable the PIM controller and connect via Orbit.*

2. **Once connected to Orbit, use the 'Find ALL Modules' button to identify all the Orbit modules available on the Orbit network connected to the PIM.**
   a. *Modules can also be added by ID, or using 'Notify' (move probe tip to add).*
   b. *Modules can be deleted from the network or the entire network cleared using the buttons provided.*
   c. *Specific setup for certain modules types can also be performed here (such as laser configuration). The "Setup Selected Module" button will become available when a module is selected that has these extra settings.*

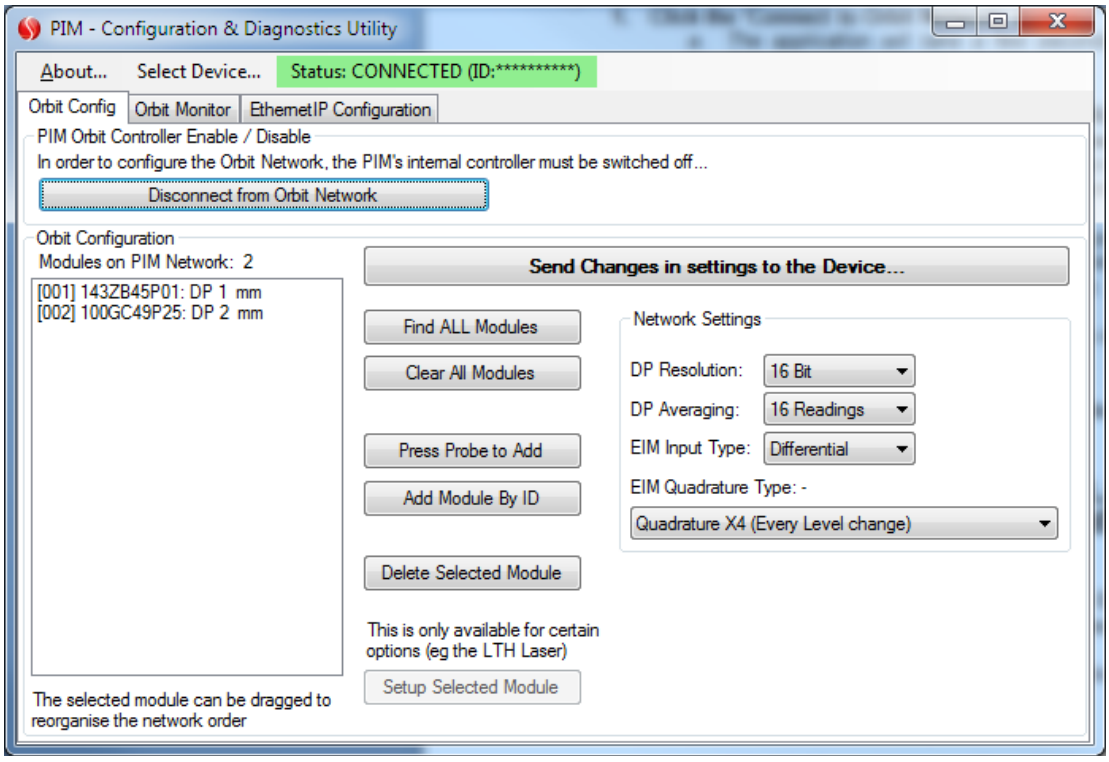
3. **Modules can be moved within the network display using the mouse to drag them to the required network position.**

4. **Additional network settings such as resolution and averaging are also configured on this tab.**

IMPORTANT: Once the network settings are configured you MUST click the "Send changes in Settings to Device" button to update the PIM.

1. **Once finished, click the "Disconnect from Orbit Network" button to revert control of the Orbit network back to the PIMs internal controller.**

The diagram below shows the Orbit Network Configuration tab and its controls.


PIM - Configuration & Diagnostics Utility
About...
Select Device...
Status: CONNECTED (ID:**********)
Orbit Config
Orbit Monitor
EthernetIP Configuration
PIM Orbit Controller Enable / Disable
In order to configure the Orbit Network, the PIM's internal controller must be switched off...
Disconnect from Orbit Network
Orbit Configuration
Modules on PIM Network: 2
[001] 143ZB45P01: DP 1 mm
[002] 100GC49P25: DP 2 mm
Send Changes in settings to the Device...
Find ALL Modules
Clear All Modules
Press Probe to Add
Add Module By ID
Delete Selected Module
This is only available for certain options (eg the LTH Laser)
Setup Selected Module
Network Settings
DP Resolution: 16 Bit
DP Averaging: 16 Readings
EIM Input Type: Differential
EIM Quadrature Type: -
Quadrature X4 (Every Level change)
The selected module can be dragged to reorganise the network order

9.1.3. Measurement Resolution, Averaging and Bandwidth

The Orbit PIM has the ability to set the probes into three resolution options, 14 bit, 16 bit (default factory setting) and 18 bit. The table below shows the best resolution (1 bit that is theoretically possible) with different probe measurement ranges.

Range mm	0.5	1	2	5	10	20
Resolution µm (18 bit)	0.00	0.00	0.01	0.02	0.04	0.08
Resolution µm (16 bit)	0.01	0.02	0.03	0.08	0.15	0.31
Resolution µm (14 bit)	0.03	0.06	0.12	0.31	0.61	1.22

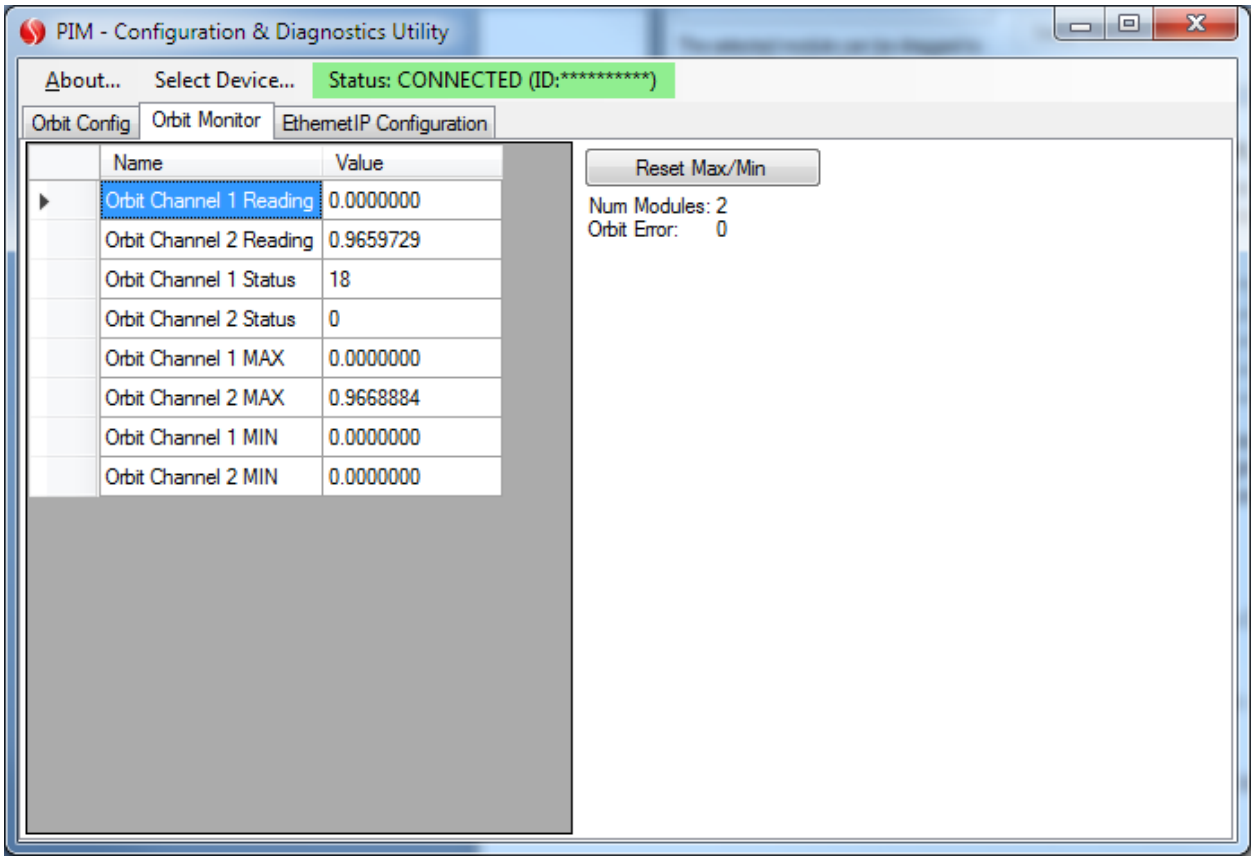
Averaging improves the signal to noise ratio, but reduces the measurement bandwidth. Generally, using a higher resolution requires more averaging. The averaging is expressed in terms of the number of base reading cycles for the probe where a reading cycle corresponds to 256uS. The update rate of the Orbit PIM depends upon the size of the network.

9.2. Orbit Monitoring Tab

Selecting the “Orbit Monitor” tab provides a view of the Orbit Network Information, including the Reading, Max, Min and Status of each module on the network.

This tab also provides the Orbit Network Error Status and number of modules as well as a button for resetting Max / Min for all modules.

The diagram below shows the Orbit Monitoring tab and its controls. Note the PIM has only two modules configured on the Orbit Network.



9.3. Module Status Codes

Modules can report many status codes however the more common are shown below: -

Module Status Code	Description
0	All Ok
18	Under Range
19	Over Range
256	No Module Configured

The display on the PIM will show a reading, UnderRange, OverRange or Error for all other error codes. The actual error number can be read from parameters.

10. Miscellaneous

10.1. Firmware Upgrades

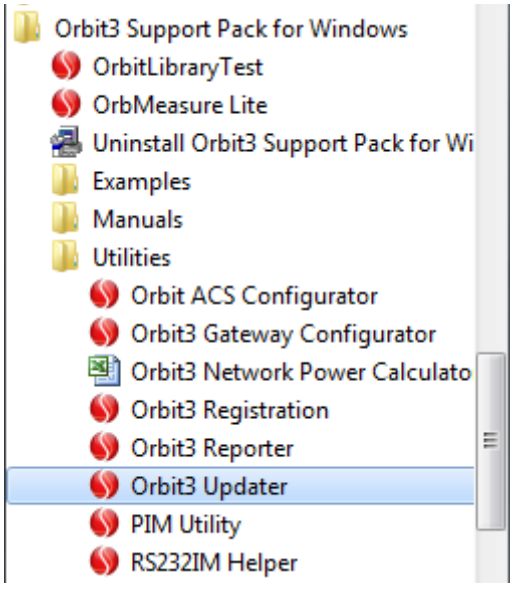
From time to time, enhancements may become available for the Orbit range, including the PIM itself as well as the connected Orbit Modules.

These product firmware upgrades can be implemented using the Orbit3 Updater utility, via the USB Mini B port on the rear of the unit. The PIM itself and the connected orbit modules can all be updated using this mechanism.

The unit must be powered in the normal way as it is not powered via the USB lead.

The utility is part of the 'Orbit3 Support Pack for Windows'. It can be downloaded from the Solartron Metrology website.

Once installed, it is located here: -



Follow the on screen instructions for the Updater.

Note. After running the firmware upgrade it is advisable to power cycle the Orbit PIM and its Orbit Network to allow the changes to fully take effect.

11. PLC Network Protocols

11.1. EtherNet/IP

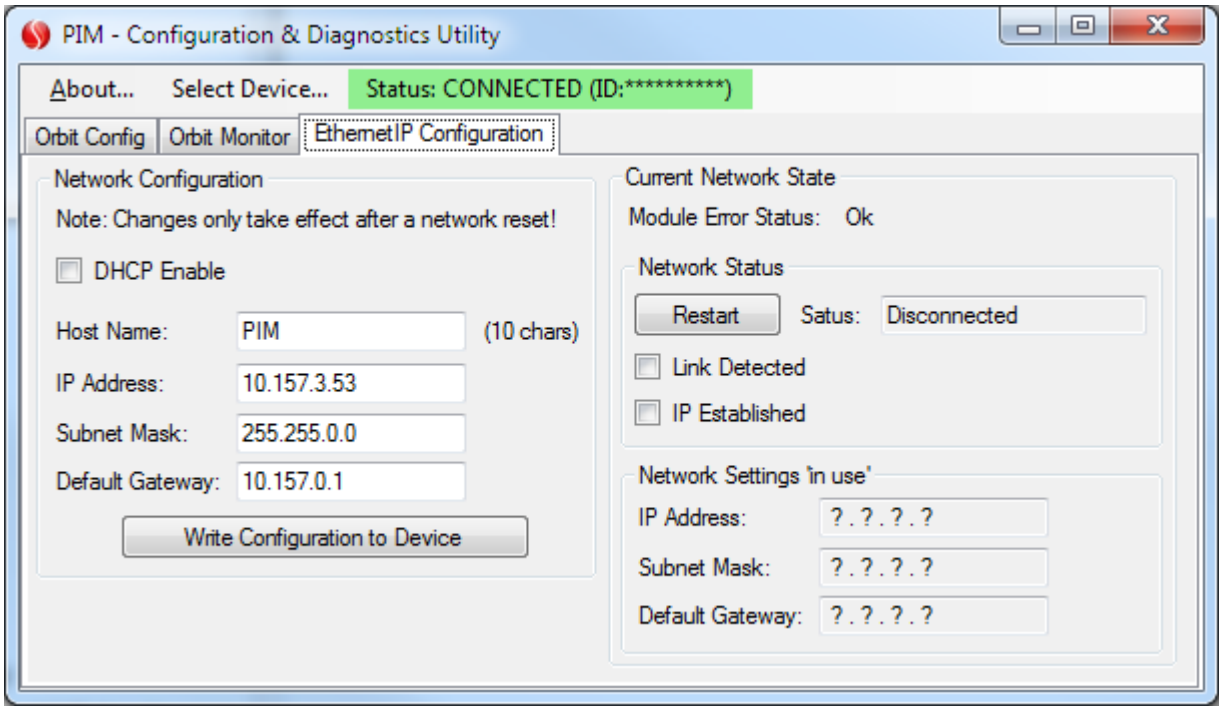
The Orbit® PIM EtherNet/IP variant product provides communications between an Orbit® network of instruments and an EtherNet/IP Controller / PLC.

This section provides the information required to configure the PIM on the EtherNet/IP Network as well as accessing parameterised information from the Orbit Network via the PIM's EtherNet/IP interface.
It does not attempt to cover any information regarding the specific programming or configuration of any Controller / PLC. Please see your Controller / PLC documentation.

The EtherNet/IP interface supports 10/100Mbit, full or half duplex operation.

11.1.1. EtherNet/IP Configuration Tab

The EtherNet/IP configuration tab on the Windows Application will appear as shown below: -



The left side of the interface provides controls for configuring the connection to the EtherNet/IP Network and the right side shows the current status of the connection.

If DHCP is 'Enabled', the configuration controls for IP Address, Subnet Mask and Default Gateway are disabled as the unit will obtain network settings from the DHCP server. The only setting available with DHCP Enabled is the "Host Name".

Within the PIM, the "Host Name" is limited to a maximum of 10 characters.

The settings obtained will be shown in the Current Network State fields once the connection has been established – whether a fixed IP address etc is in use (DHCP Disabled) or not

(DHCP Enabled). This provides conclusive values for the settings the device is using on the EtherNet/IP Network.

When settings have been updated, click the “Write Configuration to Device” button to update the PIM with the new settings – you will be provided with an option to also restart the external interface.

The external Network interface can be restarted manually using the button provided, however when changing the state of DHCP Enable, re-connecting can take some time.

11.1.2.Communications Information

The EtherNet/IP variant of the PIM provides both Explicit and Implicit messaging. The following sections describe these interfaces and the settings needed to extract information.

11.1.2.1.Explicit Messaging

These types of messages are used to access specific parameter values individually.

Note: No Data Synchronisation of module Readings can be maintained with this type of messaging. A read of a Module Reading parameter will provide the latest value available, subsequently accessing another module reading parameter will not necessarily yield a reading from the same ‘set’ of data on the Orbit Network i.e. the entire Network of Orbit Readings could have been updated between Explicit Parameter ‘Reads’.

The Explicit Messaging Settings required to access parameter instances are as follows: -

Service #	**0x01**
Class #	**0x0F**

The parameter instance numbers, parameter type and detailed information are provided in the file “PIM_EtherNetIP_IF_ADI_Map.csv”

11.1.2.2.Implicit Messaging

These types of messages are used to read or write a ‘block’ of data.

Note: The Orbit Network ‘Readings’ are available in the ‘read’ block of data, and the data contained within a reply to this type of message will contain a set of Synchronised Readings from the Orbit Modules, where Synchronised means all the readings were sampled within a 256uS window of each other.

The Implicit messaging settings required to communicate with the PIM are as follows: -

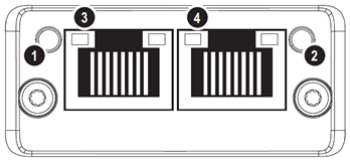
Unicast Connection Type.	
Read Assembly Instance	**100**
Write Assembly Instance	**150**
Configuration Assembly Instance	**3**

For details of the Read-able block using implicit messaging, please see the file “PIM_EthernetIP_IF_CyclicRead.csv”, which includes details of total block size, parameter types as well as byte offsets in the response ‘block’ of data.

For details of the Writable block using implicit messaging, please see the file “PIM_EthernetIP_IF_CyclicWrite.csv” , which includes details of total block size, parameter types as well as byte offsets in the ‘block’ of data.

11.1.3.Status Indicators

#	Item
1	Network Status LED
2	Module Status LED
3	Link/Activity LED (port 1)
4	Link/Activity LED (port 2)



Anybus Ethernet/IP Module

Network Status LED (1)

Note: A test sequence is performed on this LED during start-up

LED State	Description
Off	No power or no IP address
Green	Online, one or more connections established (CIP Class 1 or 3)
Green, flashing	Online, no connections established
Red	Duplicate IP address, FATAL error
Red, flashing	One or more connections timed out (CIP Class 1 or 3)

Module Status LED (2)

Note: A test sequence is performed on this LED during start-up.

LED State	Description
Off	No power
Green	Controlled by a Scanner in Run state
Green, flashing	Not configured, or Scanner in Idle state
Red	Major fault (EXCEPTION-state, FATAL error etc.)
Red, flashing	Recoverable fault(s). Module is configured, but stored parameters differ from currently used parameters.

LINK/Activity LEDs (3 & 4)

LED State	Description
Off	No link, no activity
Green	Link (100 Mbit/s) established
Green, flickering	Activity (100 Mbit/s)
Yellow	Link (10 Mbit/s) established
Yellow, flickering	Activity (10 Mbit/s)

12. Accessories

806127-xxx	Orbit cables specifically designed to ensure good system performance. Available in various lengths.
804067-3	Screwlock kit (supplied with cables).
971000-3	TCON connector (for mounting/connecting Orbit modules)
209501	Orbit3 Earth and Mounting Bracket – used to mechanically lock the TCONS together in environments subject to vibration and to produce a good earth to chassis at the TCON backbone.
802968	Terminator Connector used to provide a matched impedance and to be connected at the end of the TCON backbone

13. Return of goods

See user leaflet

14. Revision History

REVISION	DATE	COMMENTS
1	14/07/15	Initial issue
2	04/08/15	Added Installing the Orbit3 Support Pack for Windows® software